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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/757,586	01/15/2004	Robert D. Edwards	EI-2-04-001	4656

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EXAMINER

VAN, LUAN V

ART UNIT	PAPER NUMBER
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1753

DATE MAILED: 03/28/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/757,586	Applicant(s) EDWARDS, ROBERT D.	
	Examiner Luan V. Van	Art Unit 1753	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 07 February 2006.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 19-38 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 19-38 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Response to Amendment

Applicant's amendment of February 7, 2006 does not render the application allowable.

Status of Objections and Rejections

The rejection of claims 1-18 is obviated by Applicant's cancellation.

All rejections from the previous office action are withdrawn in view of Applicant's amendment..

New rejections under 35 U.S.C. 103(a) are necessitated by the amendments.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.

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2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claims 19, 20, 23, 27, 28, 29, 30, 33, 37 and 38 are rejected under 35 U.S.C. 103(a) as being unpatentable over Taylor '727 in view of Taylor '833.

Regarding claim 19 and 29, Taylor '727 teach a method of electrolytically plating a layer of metal on the internal surface of an opening within a printed circuit board, said method comprising: substantially immersing a substrate having an opening therein within an electroplating bath containing ions of a metal to be deposited onto the internal surface of said opening (Example); and passing an electric current through said bath (Example) wherein said current includes modulated forward and reverse pulses having a duration of from about 0.83 μ s to about 200 ms (column 9 lines 17-22), selected ones of said forward and/or reverse pulses followed by a pause (off-period, column 6 lines 36-40) in said electric current, so as to deposit a substantially uniform layer of said metal on said internal surface of said opening without filling said opening with said metal (figure 3C). Taylor '727 specifically teach "An off-period or relaxation period may follow either or both of the cathodic and anodic pulses" (column 6 lines 36-40).

Taylor '727 differs from the instant claims in that the reference does not explicitly disclose the specific off - period time duration nor the aspect ratio of the instant claims, although number teach "the petitioner will adapt the pulse width, duty cycle, and frequency to a particular application, based on the principles and teachings of the

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process of the invention" (column 8 lines 17-21), and through holes typically have diameters greater than about 250 μm (column 8 lines 46-54).

Taylor '833 teach a pulse reversing current electroplating process in which an experiment was performed with another board using waveform comprising a cathodic pulse of 28 amperes per square foot current density for 13.7 milliseconds, followed by a period of no current for 0.3 milliseconds, and then an anodic pulse of 28 amperes per square foot for 2 milliseconds (Example). The circuit board was provided with through holes having aspect ratios of about 3:1 to 20:1 (Example).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the method of Taylor '727 by using the off - period time of Taylor '833, because such off - period time would provide a uniform electroplated metal in the interior surfaces of through-holes, cavities and the like having high aspect ratios (column 3 lines 62-65). It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the method of Taylor '727 by using the circuit board having the aspect ratios of Taylor '833, because such circuit board would be desirable for forming a double-sided and multilayer printed wiring boards.

Regarding claims 20 and 30, Taylor '833 teach the ratio of times of the forward pulse to the reverse pulse to the pause is about 46:7:1, as calculated from the parameters in the Example provided above. It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the method of Taylor '727 by using the the ratio of times of Taylor '833, because it would provide a

uniform electroplated metal in the interior surfaces of through-holes, cavities and the like having high aspect ratios (column 3 lines 62-65).

Regarding claim 23 and 33, Taylor '727 teach an electroplating method wherein the electroplating bath further includes organic brighteners and carriers (column 14 line 58 -- column 15 line 30).

Regarding claims 27 and 37, Taylor '727 teach an electroplating method wherein the substrate is a fiberglass-reinforced epoxy resin (column 16 lines 10-12).

Regarding claims 28 and 38, Taylor '727 teach electroplating copper (Example).

Claims 21, 22, 24, 31, 32 and 34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Taylor '727 in view of Taylor '833, and further in view of Martin et al.

Taylor '727 and Taylor '833 teach the method as described above. The references differ from the instant claims in that the references do not explicitly disclose the specific current density of the instant claims (claims 21 and 31); the specific ratio of the current densities (claims 22 and 32); nor the copper concentration of the instant claims (claims 24 and 34).

Martin et al. teach "an improved method for electrodepositing metal onto a substrate. This inventive process is particularly useful for electroplating substrates with apertures or uneven surfaces. By applying this process, it is possible to improve the surface appearance including brightness, grain structure and through-hole levelling of the electrodeposit, while maintaining throwing power at high current densities" (column 3 lines 38-46). A current density in the range of between 5 and 200 and preferably 20

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to 100 ASF is typically used (column 4 lines 32-34). Power is supplied for as long as is necessary to produce the desired deposits. Furthermore, "more complex variations are also contemplated by the invention. After the first and second time periods described above, a third time period can be applied, where the ratio of peak reverse current density to peak forward current density is held at 3 to 1. During a fourth time period the ratio is held at 2 to 1. After the fourth time period, the sequence may be repeated over the entire plating time" (column 4 lines 59-65). Additionally, Martin et al. teach the bath comprising 15 to 75 g/L copper sulfate pentahydrate, or about 4-19 g/L of copper, which is within the range of the instant claim.

Addressing claims 21, 22, 31 and 32, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the method of Taylor '727 by using the current densities and ratio of the current densities of Martin et al., because these current densities would improve the surface appearance including brightness, grain structure and through-hole levelling of the electrodeposit, while maintaining throwing power at high current densities (column 3 lines 38-46).

Addressing claims 24 and 34, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the method of Taylor '727 by using the copper concentration of Martin et al., because it would improve the grain structure of the electrodeposited copper.

Claims 25, 26, 35 and 36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Taylor '727 in view of Taylor '833, Martin et al., and further in view of Sonnenberg et al.

Taylor '727, Taylor '833 and Martin et al. teach the method as described above. The references differ from the instant claims in that the references do not explicitly disclose the specific acid concentration of the instant claims (25 and 35).

Sonnenberg et al. teach an acid copper plating solution used for plating through-holes in printed circuit manufacture wherein the copper plating solution has an acid concentration of 100-300 g/L (table 1).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the method of Taylor '727, Taylor '833 and Martin et al. by using the acid concentration of Sonnenberg et al., because such concentration would enhance the thickness uniformity of the deposit.

Regarding claims 26 and 36, Taylor '727 teach using sulfuric acid (Example).

Response to Arguments

Applicant's arguments filed February 7, 2006 have been fully considered but they are not persuasive.

In the arguments presented on page 6 of the amendment, the applicant suggests that Hey and Tsuchida do not disclose the new limitation of electroplating on an internal surface of a hole "without filling said hole" with a metal. The examiner agrees, and thus the rejections using Hey and Tsuchida under 35 U.S.C. 102(e) have been withdrawn.

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New rejections under 35 U.S.C. 103(a) are therefore appropriate. Applicants' arguments with respect to claims 1-18 have been considered but are moot in view of the new ground(s) of rejection. As described above, Taylor '727 teach a method of electrolytically plating a layer of metal on the internal surface of a through - hole within a printed circuit board without filling said hole (figure 3 C). The examiner believes that he has met the requirement for a prima facie case of obviousness.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

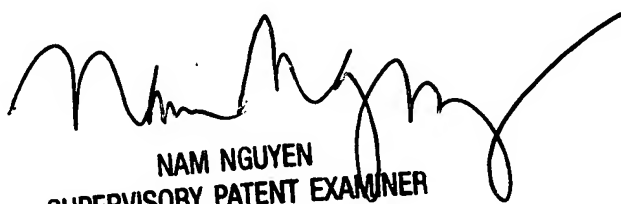
A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Luan V. Van whose telephone number is 571-272-8521. The examiner can normally be reached on M-F 9:30-6:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam Nguyen can be reached on 571-272-1342. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

LWV
3/21/2006



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